What is claimed is:

1. An apparatus for analyzing ionic species using a time-of-flight mass analyzer comprising:

an atmospheric pressure ionization source which produces ions for transmissions to a time-of-flight mass analyzer;

a two dimensional ion guide for enhancing the transmission efficiency of said ions, said ion guide operating between said atmospheric pressure ion source and said time-of-flight mass analyzer,

said ion guide having a set of equally spaced, parallel, multipole rods and operating in the RF-only mode of operation,

said ion guide having an ion entrance section where said ions enter said ion guide and an ion exit section where said ions exit said ion guide, and having an ion entrance lens placed at said ion entrance section and an ion exit lens at said ion exit section,

said ion guide being positioned such that said ion entrance section is placed in a region where background gas pressure is at viscous flow, and such that the pressure along said ion guide at said ion exit section drops to molecular flow pressure regimes without a break in the structure of said ion guide,

said ion guide being operated in the ion storage mode using a fast voltage switching device to switch voltage levels of said ion guide exit lens;

a time of flight acceleration region where said ions are pulsed out momentarily to be mass analyzed, said ions being pulsed in said time of flight acceleration region

by an acceleration field and being injected into said acceleration region orthogonal to the direction of said acceleration field;

a detector where said ions are mass analyzed according to their arrival times; and, an accurate timing device that synchronizes said voltage switching device, and which determines the respective voltage levels and the duration of said voltage levels of said ion guide exit lens and said time-of-flight acceleration field to each other;

2. A time-of-flight mass spectrometer according to claim 1, wherein said mass analyzer contains a reflectron to compensate for energy distribution of ions in said acceleration region.

3. The apparatus according to claim 1, wherein said two dimensional ion guide is in a configurations that contains said ions in the perpendicular direction with respect to the longitudinal ion beam axis.

4. The apparatus according to claim 1, wherein said multipole ion guide has at least four rods.

5. The apparatus according to claim 1, wherein said ions are injected axially into said acceleration field of said time-of-flight mass analyzer.

6. A method for analyzing ionic species using a time-of-flight mass analyzer, comprising the steps of:

producing ions in an atmospheric pressure ionization source for tranmission to a time-of-flight mass analyzer;

enhancing the effeciency of transmission of said ions from said ion source to said time-of-flight mass analyzer using a two dimensional ion guide operating between said ion source and said time-of-flight mass analyzer;

operating said ion guide in the RF-only mode of operation, said ion guide having a set of equally spaced, parallel, multipole rods, and having an ion entrance section and an ion exit section;

placing an ion guide entrance lens at the end of said ion guide where said ions exit said ion guide;

positioning said ion guide such that said ion entrance section is located in a region where the background gas pressure is at viscous flow, and such that the pressure along said ion guide at said ion exit region drops to molecular flow pressure regimes without a break in the structure of the said ion guide;

operating said ion guide in ion storage mode using a fast voltage switching device, to switch the voltage levels of said ion guide exit lens between levels that empty and trap said ions;

injecting said ions in the orthogonal direction into the time-of-flight acceleration region where said ions are to be mass analyzed by switching on the electric field in said time-of-flight acceleration region after a time delay of the appropriate voltage level of said ion guide exit lens is switched to empty said ions;

detecting said ions according to their arrival times at the end of said time-of-flight mass analyzer;

storing said ions which enter continuously into said ion guide during the said mass analysis operation by switching the voltage level of said ion guide exit lens to a level to trap said ions along said ion guide between said ion guide entrance lens and said ion guide exit lens; and,

using an accurate timing device synchronizing the switching of the respective voltage levels and the duration of said respective voltage levels of said ion guide exit lens and the time-of-flight acceleration fields.

7. The method for analyzing ionic species using a time-of-flight mass analyzer according to claim 6, wherein said mass analyzer contains a reflectron to compensate for energy distribution of said ions which are in said acceleration region.

8. The method for analyzing ionic species using a time-of-flight mass analyzer according to claim 6, wherein said two dimensional ion guide is in a configuration that contains said ions in the perpendicular direction with respect to the longitudinal ion beam axis.

9. The method for analyzing ionic species using a time-of-flight mass analyzer according to claim 6, wherein said multipole ion guide has at least four rods.

10. The method for analyzing ionic species using a time-of-flight mass analyzer according to claim 6, wherein said ions are injected axially into said acceleration field of said time-of -flight mass analyzer.